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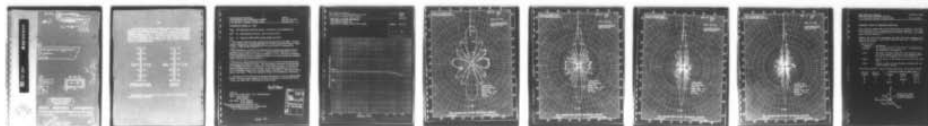
NAVAL RESEARCH LAB ORLANDO FLA UNDERWATER SOUND REFE--ETC F/G 9/1  
DESIGN, CONSTRUCTION, AND CALIBRATION OF F53 TRANSDUCER SERIAL --ETC(U)  
JUL 71

UNCLASSIFIED

USRD-CALIBRATION-3268

NL

1 OF 1  
AD A  
066889



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DDC

901B2

LEVEL II

USRD-Calibration  
KUS-301107-1013

3268

MOST Project

6

Design, Construction, and Calibration of

F53 Transducer

Serial X24

11

28 July 1971

12

9p.

DDC

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APR 4 1972  
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Naval Research Laboratory  
UNDERWATER SOUND REFERENCE DIVISION  
P.O. Box 8337, Orlando, Florida 32806

HD/hs  
K03-30.101/4024  
20 July 1971

**CALIBRATION REPORT No. 3268**

**Subj:** F53 transducer serial X2; design, construction, and calibration of

**Ref:** (a) Work Request 419/WR-1-0017 of 20 Nov 1970

**Encl:** (1) Drawings USRD 66856 through 66860 and 62785

1. The subject transducer was designed and constructed at the USRD, utilizing ceramic piezoelectric cylinders furnished by the Naval Ammunition Depot, Crane, Indiana. Funds for the calibration service were provided by reference (a).

2. The transducer is a line of 20 modified barium titanate end-capped ceramic cylinders 3.81-cm long x 3.81-cm o.d., having the wall thickness 0.32 cm. Spacing between ends of the ceramic cylinders is 1.5 cm. The line of cylinders in the experimental model is enclosed in Tygon B 44-3 tubing (polyvinyl chloride), which is filled with air-free castor oil.

3. Free-field voltage sensitivity and directivity in the XZ (vertical) plane were measured at the Leesburg Facility. The measurement conditions and the results are shown in enclosure (1). Sensitivity in the frequency range 1 to 20 kHz was measured in the Anechoic Tank Facility at the water temperatures 3 and 30°C and at hydrostatic pressure to 6.89 MPa (gage), equivalent to 1000 psig or 689 m depth in sea water. There was negligible change with temperature or pressure.

4. Orientation was according to the method described for a line on drawing USRD 62785. The type number molded in the Tygon tubing was in the direction of the +X axis; the cable was in the direction of the +Z axis.

*Harold Dennis*  
HAROLD DENNIS

**Copy to:**

NAD Crane (Code 7022C, C.P. Kutrumanes)(1)

USRD (Code 8270)(1)

(Code 8280)(1)

NRL Wash (Code 2620)(1)

(Code 1265)(1)

USRD (Code 8270)(1)(30 Jul 1971)

NAVSHIPSYSCOM (Code 901, Glenn Moore,  
M.M. Giwer)(3)(18 Feb 1972)

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USRD No. 66856  
4024

Date Jun 1971

**FREE-FIELD VOLTAGE SENSITIVITY**

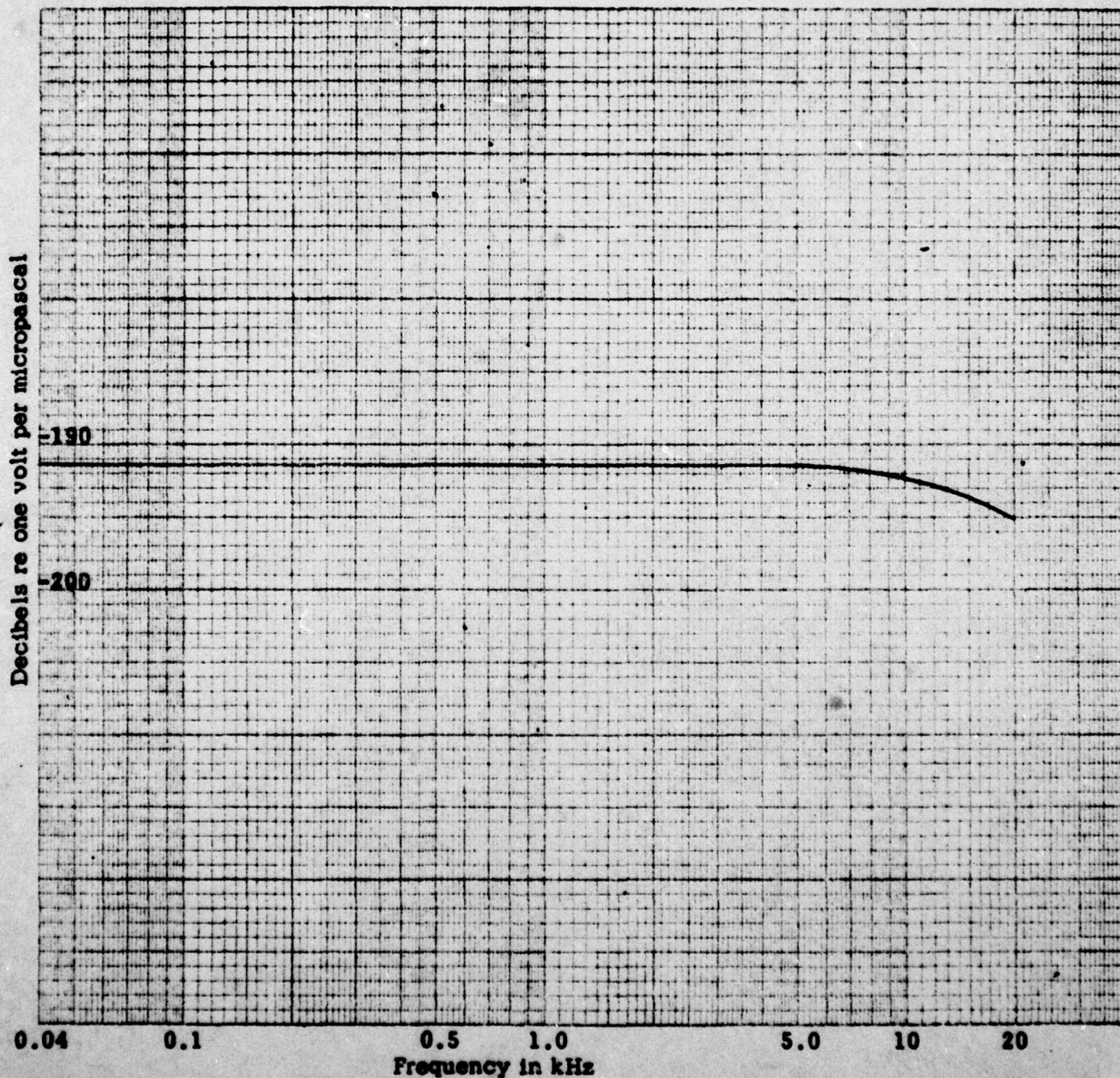
F53 Transducer Serial X2

Open-circuit voltage at end of 36-m cable

Depth: 14.7 m

Water temp. 22 °C

MEASUREMENTS MADE IN ACCORDANCE WITH AMERICAN STANDARD Z 24.24-1957





30° 20° 10° 0 350° 340° 330°  
330° 340° 350° 10° 20° 30°

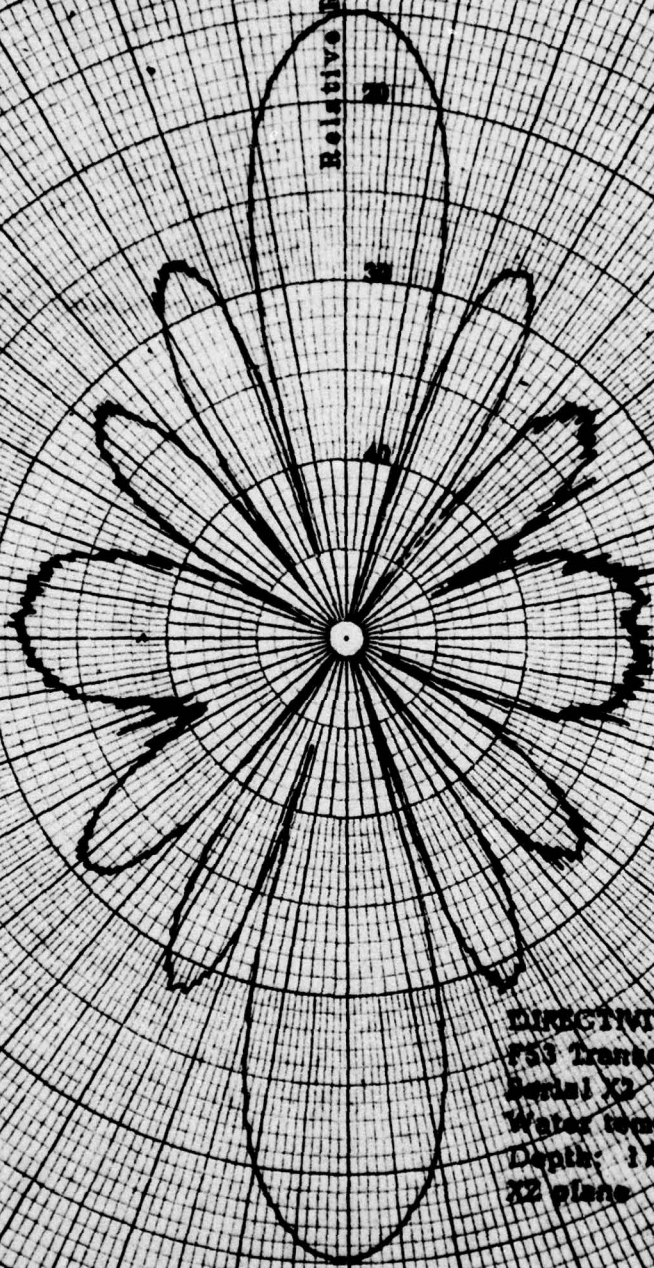
NOTE: ALLOW 3% IN FOR PAPER  
STRETCH AND CENTERING. USE  
SCALE TO CHECK OR INDICATE DIRECTIONALITY.

USRD NO. 56857  
4934

DATE: Jun 1971

MEASUREMENTS MADE IN ACCORDANCE WITH AMERICAN STANDARD Z39.1-1965

Relative Response in dB



DIRECTIVITY  
F53 Transducer  
Serial X2  
Water temp: 22°C  
Depth: 17.7 m  
32 plane

5.0 kHz

U.S. NAVY UNDERWATER SOUND REFERENCE DIVISION

NO. 3124

ORLANDO, FLA 32808

150° 160° 170° 180° 190° 200° 210° 220° 230° 240° 250° 260° 270° 280° 290° 300° 310° 320° 330°  
150° 160° 170° 180° 190° 200° 210° 220° 230° 240° 250° 260° 270° 280° 290° 300° 310° 320° 330°

USRD ORL 56857/4934 (3/70)  
160° 150°



30°  
330°20°  
340°10°  
350°350°  
10°340°  
20°330°  
30°

NOTE: ALLOW 50% FOR PAPER  
STRETCH AND COMPRESSING. USE  
SCALE TO DETERMINE DIRECTIONALITY.

USRD NO. 55553  
4034

DATE: Jun 1971

MEASUREMENTS MADE IN AC-  
CORDANCE WITH AMERICAN  
STANDARD Z39.2-1969

Relative Response in dB

DIRECTIVITY  
F52 Transducer  
Serial X2  
Water temp: 21°C  
Depth: 17.7 m  
XZ plane

15 kHz

NRL UNDERWATER SOUND REFERENCE DIVISION

P.O. BOX 1331

CHLANTO, FLA 33508

150°  
210°160°  
200°170°  
190°180°  
180°190°  
170°200°  
160°210°  
150°

USRD CML 3302/5700 3/70



30° 330° 20° 340° 330°  
330° 340° 350° 10° 10° 20° 30°

NOTE: ALLOW FOR PAPER  
STRETCH AND CENTERING. USE  
SCALE TO CHECK ORIENTATION ONLY.

USPD NO. 66859  
4024

DATE: Jun 1973

MEASUREMENTS MADE IN ACC.  
CONFORMANCE WITH AMERICAN  
STANDARD Z39.1-1962

Relative Response in dB

10

20

30

40

50

60

70

80

90

100

110

120

130

140

150

160

170

180

190

200

210

220

230

240

250

260

270

280

290

300

310

320

330

340

350

360

370

380

390

400

410

420

430

440

450

460

470

480

490

500

510

520

530

540

550

560

570

580

590

600

610

620

630

640

650

660

670

680

690

700

710

720

730

740

750

760

770

780

790

800

810

820

830

840

850

860

870

880

890

900

910

920

930

940

950

960

970

980

990

1000

1010

1020

1030

1040

1050

1060

1070

1080

1090

1100

1110

1120

1130

1140

1150

1160

1170

1180

1190

1200

1210

1220

1230

1240

1250

1260

1270

1280

1290

1300

1310

1320

1330

1340

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1360

1370

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1400

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1490

1500

1510

1520

1530

1540

1550

1560

1570

1580

1590

1600

1610

1620

1630

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1960

1970

1980

1990

2000

2010

2020

2030

2040

2050

2060

2070

2080

2090

2100

2110

2120

2130

2140

2150

2160

2170

2180

2190

2200

2210

2220

2230

2240

2250

2260

2270

2280

2290

2300

2310

2320

2330

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2350

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2390

2400

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2470

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2500

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2600

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2660

2670

2680

2690

2700

2710

2720

2730

2740

2750

2760

2770

2780

2790

2800

2810

2820

28



30°  
330°

30°  
340°

10°  
350°

0 0

350°  
10°

340°  
20°

330°  
30°

40°  
320°

50°  
310°

60°  
300°

70°  
290°

80°  
280°

90°  
270°

100°  
260°

110°  
250°

120°  
240°

130°  
230°

140°  
220°

320°  
40°

310°  
50°

300°  
60°

290°  
70°

280°  
80°

270°  
90°

260°  
100°

250°  
110°

240°  
120°

230°  
130°

220°  
140°

NOTE: ALLOW 34 IN FOR PAPER  
STRETCH AND CENTERING USE  
SCALE TO OBTAIN CORRECT DIRECTIONALITY.

USRD NO. 66B60  
4024

DATE: Jun 1971

MEASUREMENTS MADE IN AC-  
CORDANCE WITH AMERICAN  
STANDARD Z39.1-1967

Relative Response in dB

10

20

DIRECTIVITY  
F53 Transducer  
Serial X2  
Water temp: 22°C  
Depth: 17.7 m  
XZ plane

20 dB

U.S. UNDERWATER SOUND REFERENCE DIVISION

ORLANDO, FLA 32805

USRD ORL 556/516 3/70

150°  
310°

160°  
300°

170°  
290°

180°  
280°

190°  
270°

200°  
260°

210°  
250°

1 July 1970

## COORDINATE SYSTEM FOR TRANSDUCER ORIENTATION

The coordinate system shown in the sketch below is assigned to the transducer and moves with it, regardless of its physical position. The angle  $\theta$  is a depression angle measured from the +Z axis; the angle  $\phi$  is azimuth angle in sonar operation.

*Response and sensitivity* measurements are made with sound propagated parallel to the positive X axis unless otherwise specified. Transducers are oriented as follows:

Active Acoustic Surface	Orientation
Cylinder	The cylindrical axis is the Z axis. A reference mark for another axis is specified.
Plane	The plane (or piston) face is in the YZ plane, with the X axis normal to the face at the geometric center. The top of the transducer is in the +Z direction.
Sphere	Specify points on the surface for any two of the three axes.
Other	Provide a sketch of nonconforming configurations and offset acoustic centers.

*Directivity Patterns:* Unless otherwise specified, the following apply:

Specified Plane	Axis of Rotation	Position of axes on polar plots		
		+X axis	+Y axis	+Z axis
XY	Z	0°	90° cw	upward
XZ	Y	0°	downward	90° cw
YZ	X	upward	0°	90° cw

